

# Black Bear Use Response to a Wind Energy Project in Southern Vermont



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## Background

- The Vermont Fish and Wildlife Department (VFWD) contracted Western EcoSystems Technology, Inc. (WEST) to design and carry out a study of black bear (*Ursus americanus*) response to the construction and operation of the Deerfield Wind Energy Project (DWEF) in Bennington County, Vermont, within the Green Mountain National Forest.
- The study is being funded by DWEF as a condition of Vermont Public Service Board review for the 15 turbine project.
- The primary goal of the study is to determine if bears respond to the various potential disturbances associated with construction and operation of the DWEF, and to document any changes in responses, over time.
- Of primary concern to VFWD is the location of the DWEF within an area containing regionally high concentrations of bear scarred beech trees (BSB). American beech (*Fagus grandifolia*) provide an important hard mast food source to black bears and BSB is considered an indicator of high value habitat. The VFWD is concerned that construction and/or operation of the DWEF could alter use of this habitat and/or behavior.



## Objectives

- To evaluate the movements and habitat use of black bears in response to the construction and operation of the DWEF. Determine the extent of indirect effects resulting from the project and quantify displacement distances, if possible.
- To evaluate the behavioral response of black bears to the wind turbines during days that the turbines are operating or feathered or shut down completely.
- To determine if study animals using BSB for extended periods of time are more or less likely to be involved with human-bear conflicts than bears not using BSB habitat.

## Study Elements

- Live trapping to capture study animals suitable for attachment of GPS telemetry collars.
- Study animals monitored over multiple years during pre-construction, construction and post-construction periods.
- Den visits to replace collars and assess health and reproductive status of study animals.
- Habitat mapping and annual mast surveys useful for interpreting potential differences in annual movements and habitat use of bears.
- Compilation of human activity data and information on bear-human conflicts.



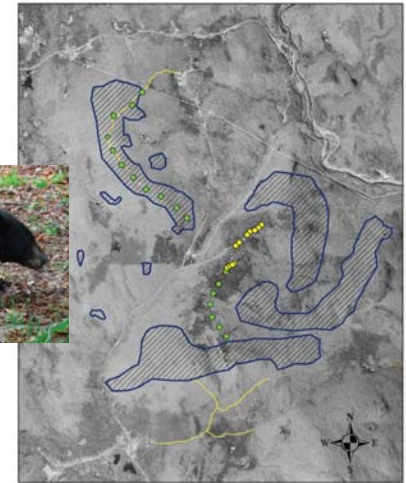
## Bear Capture

- During fall 2011, spring and summer 2012 live capture initiated.
- Leg snares used and captured animals chemically immobilized.
- Morphometrics collected, tooth extraction for ageing, hair and tissue sampling for DNA analysis.
- Young males (<2 years of age) released without fitting GPS collars.
- During fall 2011 2 males fitted with store on board Telonics TGW-4500-2 GPS collars.
- During spring and summer 2012 1 female and 1 male fitted with TGW-4500-2, 1 female and 3 males fitted with Lotek Iridium Track M GPS.

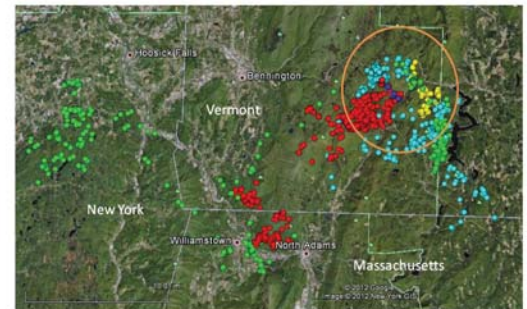
## Data Analysis

- Year to year and pre- and post-construction period changes in movements, habitat use, and activity of individual bears will be assessed to test for associations with the presence of the DWEF. Testing at seasonal level to account for seasonal variation in ecology.
- Accounting for annual variation in weather, mast production, other factors which can influence bear behavior.
- Assessment of second-order habitat selection (i.e. selection of a home range within a landscape using brownian bridge home range analysis (Nielson et al. 2011) with R (R Development Core Team 2011).
- Annual and seasonal home ranges will be mapped relative to the DWEF. Two characteristics will be used to evaluate spatial shifts in home range locations: minimum distance between the home range edge and DWEF, and percent of the home range that overlaps the DWEF (or some appropriate buffer distance).
- Potential effects of the DWEF on habitat use will be assessed by utilizing resource selection function models (RSF) adjusted for GPS fix success (Nielson et al. 2009), which combine a classic logistic discrete-choice model (McDonald et al. 2006) and a GPS fix success model.
- For each individual, seasonal habitat selection will be modeled for each year. Excluding DWEF covariates, Akaike Information Criteria (AIC or AICc) model selection (Burnham and Anderson 2002) will be used to identify the most informative natural and anthropogenic covariates, for an appropriate subset of individuals, e.g., females. a common set of covariates will be selected for use in development of a population level model.
- Following methods Sawyer et al. (2009) used to study oil field development on mule deer (*Odocoileus hemionus*) habitat use, changes in coefficients before and after construction will provide a statistically rigorous test for whether presence of the wind farm influenced habitat use.
- Changes in mean distance of highly selected habitat units from the DWEF will be examined, across years, to determine any potential displacement distances (Costello et al 2011).
- Relative use of BSB habitat among individuals will be evaluated by comparing model coefficients. Next, the correlation between use of BSB habitat and number of human-bear conflicts documented will be calculated.
- Multiple linear regression analysis will be used to model the number of conflicts in an area as a function of availability of BSB habitat nearby, as well as anthropogenic characteristics.

## Areas of Concentrated Bear Scarred Beech



Bear Scarred Beech Concentrations  
 Existing Turbines  
 Proposed Turbines  
 Map Drawn by Ryan Smith  
 Vermont Fish and Wildlife Department  
 5/18/2012



Black bear locations 2012  
 Satellite-collared animals only  
 Study Area  
 M205  
 M208  
 F210  
 F212  
 N

## Important Considerations

- Conducting long term large scale indirect effects analysis of wind energy projects on wildlife is cost intensive.
- Capture of a sufficient number of study animals to provide a sufficient sample size is often difficult to achieve and has a high degree of uncertainty (e.g. collars may malfunction, animals may be killed by hunters).
- Responses related to a wind energy facility may be difficult to distinguish from exigent or environmental factors (e.g. annual variation in mast production). It may be difficult to make conclusions without very long term studies.
- Timeframe for longitudinal study during Before/After periods may be affected by project development schedule.

## Citations

- Burnham, K. P., and D. R. Anderson (2002) Model Selection and Multimodel Inference: a Practical Information-Theoretic Approach, 2nd ed. Springer, New York, USA.
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- McDonald, T.L., B.F.J. Moyle, R.M. Nelson, and L.S. Dorris. 2006. Discrete choice modeling in wildlife studies exemplified by northern spotted owl nighttime habitat selection. Journal of Wildlife Management 70: 375-383.
- Nielson, R.M., B.F.J. Moyle, L.L. McDonald, H. Sawyer, and T.L. McDonald. 2009. Estimating habitat selection when GPS fix success is less than 100%. Ecology 90: 2956-2962.
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Mast survey plots